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ABSTRACT

One of the truly remarkable events in human evolution is the unprecedented increase in the size of the brain of "Homo" over a brief span of 2 million years. It would appear that some significant selective pressure or opportunity presented itself to this branch of the hominid line and caused a rapid increase in the brain, introducing a wholly new kind of cognitive orientation toward the external environment. The nature of the causes of this dramatic shift are presently under debate. Arguably, the remarkable increase in the size of the brain of different species of "Homo" arose from the selective advantages of a communication system permitting the exploitation of shared information. To test this evolutionary hypothesis, it is useful to look at patterns of development in humans and in our nearest primate relatives, chimpanzees. Comparison of developmental patterns of human infants and comparable chimps shows that human infants go through a developmental sequence of (1) showing an object to an adult, (2) giving objects to others, (3) pointing to objects in a communicative context, and (4) labeling objects by means of a vocalization. Infant chimps go through the stage of showing, but they do not give, point, or label. Positing the existence of a cooperative strategy in Pliocene hominids is consistent with these developmental differences. (RH)

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HUMAN DEVELOPMENT, HUMAN EVOLUTION

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HUMAN DEVELOPMENT, HUMAN EVOLUTION David Smillie

Piaget held a life long interest in the relationship between evolutionary theory and the nature of human knowledge and intelligence. This interest led to his proposal of a new field of inquiry, genetic epistemology (Piaget, 1950), to be concerned with all those disciplines that bring empirical evidence to bear on the understanding of the origins and development of human knowledge. Beginning with his biological research on lacustrine molluscs (see Gruber & Voneche, 1977) and spurred by his reading of Bergson's Creative Evolution, he initiated a line of inquiry that he pursued vigorously to the end of his long, productive career. Doing work on the standardization of tests of reasoning at Simon's school for boys in Paris, he saw the possibility of discovering the stages of an evolutionary past through psychological study of the cognitive development of contemporary humans. Recounting these early years of psychological investigation, he says,

> My permanent dream of finding a connection between 'living' forms and 'forms' of thought was realized from one day to the next. I had before me as many subjects of evolution as one finds in a primary school, and these subjects of flesh and blood passed through a series of stages which I ferreted out with a passion, leading them on at later ages...to those forms of thought considered to be universal and a priori by philosophers. (Piaget, 1959, p. 10)

From that moment, over sixty years ago, to the present, there have been major developments in evolutionary theory that permit us to reformulate Piaget's discoveries and research program in somewhat different terms. In this paper I argue that psychological evidence from investigations of human infants leads us toward the conclusion that the adoption of a new social-communicative adaptive strategy in the Pliocene may well have been the crucial event that initiated the remarkable increase in the human brain, accounting finally for typical forms of intelligence and knowledge in contemporary humans. I understand this claim as an extension of Piaget's program of genetic epistemology, even though it produces results at some variance with his conclusions.

I Human Evolution

Piaget's evolutionary thinking (e.g. Piaget, 1950; 1978) was very much taken up with grand principles that applied across phyla or kingdoms; principles that would have some reflection in human development and that would provide significant input for genetic epistemology. Today, under the influence of neo-Darwinism, we are led, rather, to the reconstruction of specific phylogenies with particular interest in the evolution of the hominid line.

One of the truly remarkable events in human evolution is the unprecedented increase in the size of the brain of Homo, over a brief span of two million years. This rapid evolutionary change is well documented by fossilized remains of the brain case of H. habilis, H. erectus, and H. sapiens. The dramatic nature of this shift can best be visualized by considering the regular pattern of brain size/body size ratios found in vertebrate species. Plotting brain size against body size on a double logarithmic scale, we find an orderly pattern of relationships for contemporary great apes and for a variety of extinct australopithecine species (see Fig. 1). This pattern is quite consistent with that found in primates generally, as well as in mammals, birds, reptiles, and fishes (Jerison, 1973). However when we plot the brain/body ratios of Homo species we get a very different picture, markedly deviant from the regular pattern found for vertebrates generally. It would appear that some significant selective pressure or opportunity presents itself to this branch of the hominid line causing a rapid increase in the brain and introducing a wholly new kind of cognitive orientation toward the external environment. The nature of the causes of this dramatic shift are presently under debate (Falk, 1980; Jerison, 1975; Martin, 1981; Wilson, 1975), constituting a fundamental issue for human sociobiology (Lumsden & Wilson, 1981, 1983).

I propose here a solution to this problem. The first step posits the existence of a complex cooperative social organization among the various species of australopithecines, differing from that of the great apes. A division of labor between males and females allows for a new food gathering strategy where males range far afield gathering or scavenging, and bringing food back to a home base occupied by females and immatures. Primitive tool use involving digging sticks and carrying devices would have been facilitated by upright posture and would have allowed a much more efficient exploitation of ecological resources (Lovejoy, 1981). Central to such a strategy is the pattern of food sharing (Isaac, 1978) and the emergence of a highly cooperative pattern of social life.

A new level of cooperative life provides the platform for a new set of communicative strategies that deal with food and artifacts as shared resources. The social focus on shared objects leads to a communication pattern allowing for shared information. Over and beyond the typical pongid social signals that regulate the social interactions of the group there appear signals that refer to things and events that have a common significance for family and group. As communication becomes referential in character, these hominids begin to open up a wholly new kind of resource, shared information.

Unlike material resources, shared information is not dissipated by use; it can be shared equally by all. Not only that, information can be harvested, stored, even transmitted across generations. There are marked advantages for a group that has access to shared information. We can imagine the selective opportunities available to those who were better able to exploit this novel resource and the possibilities of the rapid evolution of CNS capacities that conferred such advantages. I am proposing that the remarkable increase in the size of the brain of different species of Homo over the past two million years arose from the selective advantages of a communication system permitting the exploitation of shared information.

II Comparative developmental analysis

It might appear that speculations about social organization and patterns of communication in an extinct species millions of years ago represents the idle telling of "just-so stories." However, we know that evolutionary change does not proceed by reconstructing organisms to meet new adaptive challenges but rather by a process of utilizing variations of older patterns, somewhat as a tinkerer exploits whatever is available to repair or reconstruct a malfunctioning device (Jacob, 1982). Thus we find remnants of old adaptive structures in contemporary species, especially during early stages of development where selective pressures have had less opportunity to function (Smillie, in press). While no biologist today accepts Haeckel's law of recapitulation, it is evident that past adaptations have left their traces (Gould, 1977). Thus we have ways of testing evolutionary hypotheses against contemporary evidence, somewhat as Piaget (1959) suggested.

In the present instance it will be useful to look at patterns of development in humans and in our nearest primate relatives, chimpanzees, since chimpanzee evolution has been conservative over the past eight million years (King & Wilson, 1975) and human evolution has been extremely rapid.

Savage-Rumbaugh and colleagues (Savage-Rumbaugh, Pate, Lawson, Smith & Rosenbaum, 1983) have compared the developmental sequences found in human infants between nine and thirteen months (drawing on the research of Bates and colleagues, 1979) with comparable sequences in chimpanzees participating in a language training program. The human infants go through a developmental sequence of (a) showing an object to an adult, (b) giving objects to others, (c) pointing to objects in a communicative context, (d) labeling objects by means of a vocalization. Infant chimps, on the other hand, illustrate the stage of showing, but they do not go through the subsequent stages of giving, pointing, and labeling. Savage-Rumbaugh reports her experience with a young chimpanzee named Lucy who is at the stage of showing:

> Lucy selected a plastic flower from her box of toys, carried it to the author, and after smelling the flower, extended it toward her. When the author reached to take the flower, Lucy promptly bit her on the hand. The author continued to work with Lucy for several years but never again mistook champanzee showing for offering, though she continually observed other teachers repeat her mistake - even when warned. (Savage-Rumbaugh et al., 1983, p. 462)

While human infants also go through a stage of showing without the intention to give, this quickly changes to become an act of true giving. This difference in the social/communicative patterns of infant chimpanzees and infant humans highlights the emergence of a new communicative pattern in humans leading to referential gestures that indicate external objects in a fashion that allows for making a propositional statement to others about the world.

This same sequence of stages in communicative competence has been described and interpreted by Trevarthen as a shift from "primary" to "secondary intersubjectivity" (Trevarthen 1979, 1983; Trevarthen & Hubley, 1978). Primary intersubjectivity involves a communicative coordination between mother and infant in early infancy, while secondary intersubjectivity represents the development of communicative orientations toward the social other and, at the same time, toward objects that have mutual significance for each partner.

Savage-Rumbaugh et al. (1983) make it clear that the difference between ape and man in the development of a communicative strategy is not simply cognitive, since apes can be trained to adopt an indicative orientation toward objects and others. Rather, at this early stage of development, we can understand the difference as that of attention, motive, interest.

III Development and evolution

A close reading of developmental evidence in chimpanzees and humans provides support for a new interpretive account of the origins of the human mind. The existence of a cooperative strategy in Pliocene hominids is consistent with the developmental evidence of a difference in the communicative

patterns of contemporary apes and humans. Food sharing in chimpanzees rests on a communicative pattern of "begging" or requesting (van Lawick-Goodall, 1968), but not on spontaneous acts of giving. The human cooperative pattern involves a move beyond requesting to spontaneous giving as found in the gestural communication of human infants. We may understand the emergence of the next step in human communication in infancy as the development of information sharing, that is, making a statement about an object or event apart from expressions of need or desire for the object. In the developmental sequence of the human infant, giving leads on to communicative pointing, and thence to acts of labeling. Object sharing leads to information sharing and the opening up of a whole new resource space.

We return then to Piaget's youthful insight: the investigation of a developmental sequence may tell us something about an evolutionary sequence. Or, alternatively, claims about the nature of evolution can be tested against developmental evidence in a contemporary species. Piaget's program was handicapped by uncertainty about the nature of biological evolution; his primary emphasis was on an elucidation of human development. It would be folly indeed to rest an inquiry today on the kind of evolutionary theory that was available when Piaget began his work on genetic epistemology. I propose here a genetic account of human knowing that stands in rather sharp contrast to that offered by Piaget. The connecting link is not in the content but in the method, that is, in the larger program of genetic epistemology. It is only to be expected that a productive research program will move in new directions, unsuspected by its originator.

References

Bates, E. Benigni, L., Bretherton, I., Camaioni, L. & Volterra, V. (1979) The emergence of symbols: Cognition and communication in infancy. New York: Academic Press.

Falk, D. (1980) Hominid brain evolution: The approach from paleoneurology. Yearbook Physical Anthropology, 23, 93-107.

Gruber, H.E. & Voneche, J.J. (1977) The essential Piaget. New York: Basic Books.

Isaac, G. (1981) The food-sharing behavior of protohuman hominids. Scientific American, 238, 90-108.

Jerison, H.J. (1973) Evolution of the brain and intelligence. New York: Academic Press.

Jerison, H.J. (1975) Fossil evidence of the evolution of the human brain. Annual Review of Anthropology, 4, 27-58.

King, M-C. & Wilson, A.C. (1975) Evolution at two levels in humans and chimpanzees. Science, 188, 107-116.

Lawick-Goodall, J van (1968) The behavior of free-living chimpanzees in the Gombe Stream Reserve. Animal Behavior Monographs. 1, 161-311.

Lovejoy, C.O. (1981) The origin of man. Science, 211, 341-350.

Lumsden, C.J. & Wilson, E.O. (1981) Genes, mind, and culture. Cambridge: Harvard University Press.

Lumsden, C.J. & Wilson, E.O. (1983) Promethean fire. Cambridge: Harvard University Press.

Martin, R.D. (1981) Relative brain size and basal metabolic rate in terrestrial vertebrates. Nature, 293, 57-60.

Piaget, J. (1950) Introduction à l'épistémologie génétique. (3 vols.) Paris: Presses Universitaires de France.

Piaget, J. (1959) Les Modèles abstraits sont-ils opposés aux interprétations psycho-physiologiques dans l'explication en psychologie? Bulletin de Psychologie, 13, 8-13.

Piaget, J. (1978) Behavior and evolution. New York: Pantheon.

Savage-Rumbaugh, E.S., Pate, J.L., Lawson, J., Smith, S.T. & Rosenbaum, S. (1983) Can a chimpanzee make a statement? Journal of Experimental Psychology: General, 112, 457-492.

Smillie, D. (in press) Sociobiology and human culture. In J. Fetzer (Ed.) Sociobiology and epistemology. Dordrecht, Holland: D. Reidel.

Trevarthen, C. (1979) Communication and cooperation in early infancy. In M. Bullowa (Ed.) Before speech; The beginnings of human communication. London: Cambridge University Press.

Trevarthen, C. Interpersonal abilities of infants as generators for transmission of language and culture. In A. Olivero & M. Zapella (Eds.) The behavior of human infants. New York: Plenum.

Trevarthen, C. & Hubley, P. Secondary intersubjectivity: Confidence, confiding, and acts of meaning in the first year. In A. Lock (Ed.) Action, gesture, and symbol. New York: Academic Press.

Wilson, E.O. (1975) Sociobiology: The new synthesis. Cambridge: Harvard University Press.

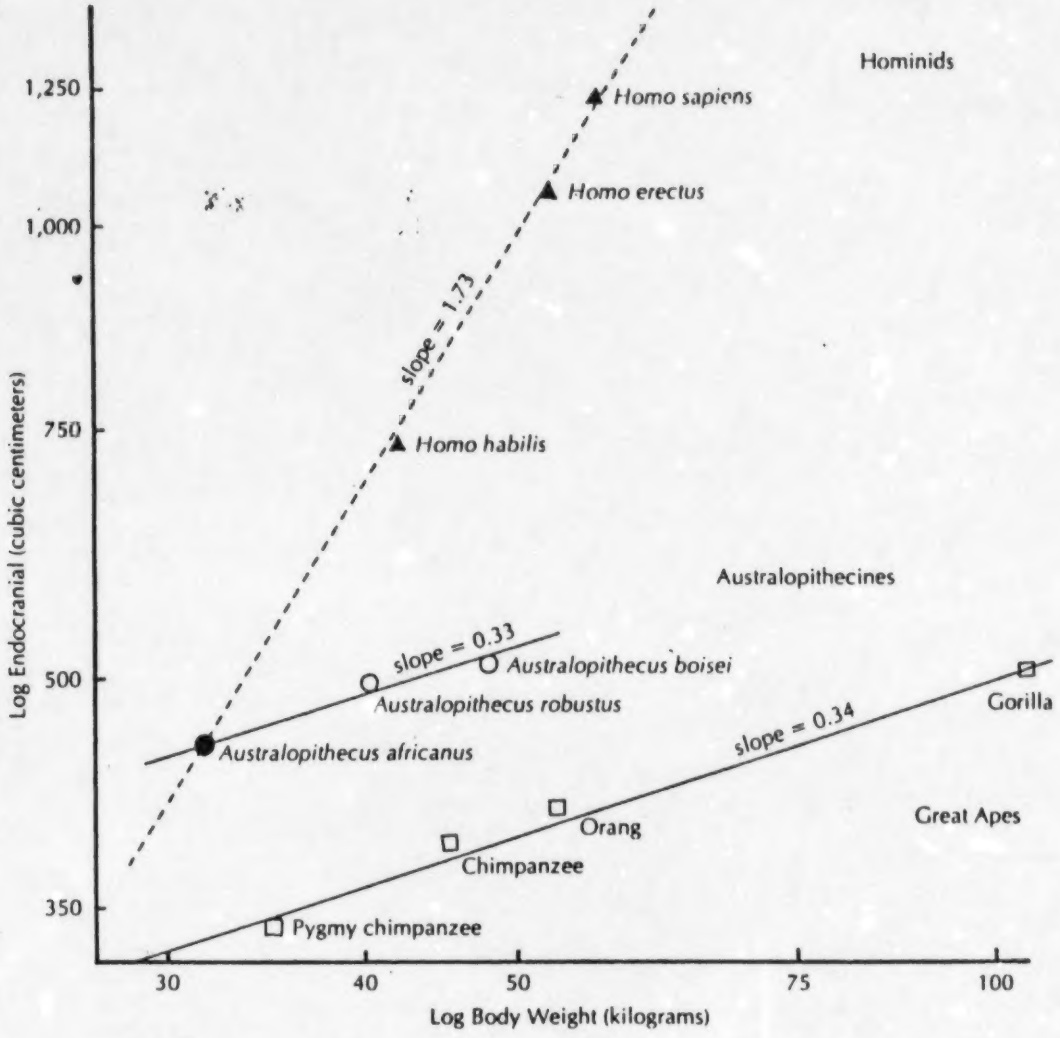

Figure 10. The endocranial volume plotted against the body weight of great apes, Australopithecines, and the *Homo* line on a logarithmic scale. For the fossil forms the body weight is, of course, only an estimate. (Redrawn from D. Pilbeam and S. J. Gould 1974.)

FIGURE 1

From Bonner, J.T. The evolution of culture in animals. Princeton: Princeton University Press, 1980.